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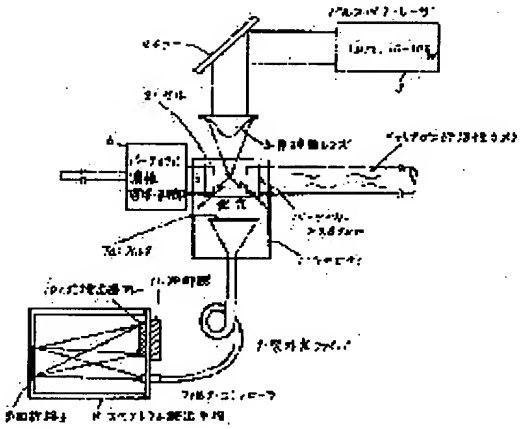
(71)Applicant : YOKOGAWA ELECTRIC CORP
(72)Inventor : SAWADA SHIRO
KITAMORI TAKEHIKO
UEDA TOSHITSUGU
NAITO SEIICHI
TAKAHARA TOSHIO
TAKAMATSU YUKIHIKO

(54) EQUIPMENT FOR MEASURING MICRO PARTICLE

(57)Abstract:
PROBLEM TO BE SOLVED: To analyze an element through a small and inexpensive arrangement by heating micro particles through irradiation with laser light, passing an emitted light through a filter in order to block intrusion of the laser light and subjecting to spectroscopy before being detected by a photodetector.
SOLUTION: The micro particle measuring equipment for analyzing the components of micro particles floating in the air comprises a cavity 1 for receiving a cell 2, a laser emitter 3, a micro particle introduction means 6 employing a cyclon, an optical fiber 7 preferably transmitting up to vacuum ultraviolet rays provided with a filter 7a for blocking intrusion of laser light at the funnel- like end part thereof, and a detection means comprising a diffraction grating 9 and a photodetector array 10. Micro particles carried on He gas, or the like, into the cell 2 from the introduction means 6 are thermally irradiated with a pulse laser of specified power to emit a light. Magnitude of the micro particle is measured from the intensity of plasma emission occurring in the early stage and the components are measured from following atomic emission. Alternatively, the micro particles may be heated by injecting microwave into the cavity 1.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] A means to introduce a particle in a cel, and a means to irradiate a laser beam at the particle in a cel, the spectrum which carries out the spectrum of the light transmitted by transmission means to transmit the light of the particle which emits light by the exposure of a laser beam, and the transmission means -- with a means the photodetector array which receives the light by which the spectrum was carried out -- since -- the particle metering device characterized by preparing the filter which prevents invasion of the wavelength of a laser beam in the preceding paragraph of said optical transmission means while making said laser beam into the wavelength besides the luminescence wavelength of a particle.
[Claim 2] The particle metering device according to claim 1 characterized by establishing a means to add alternating current electric field to the particle introduced in a cel beforehand.
[Claim 3] the spectrum which carries out the spectrum of the light transmitted by means to introduce a particle in a cel, means to make the particle in a cel emit light using the microwave plasma, transmission means transmit the light of the particle which emitted light, and the transmission means -- a means and the photodetector array which receives the light by which the spectrum was carried out -- since -- the particle metering device characterized by to become.
[Claim 4] A laser beam is a particle metering device according to claim 1 or 2 characterized by being pulsed light.
[Claim 5] The particle metering device according to claim 1 or 2 characterized by setting up the power density of the light which irradiates a particle lower than the luminescence threshold of a medium more highly than the luminescence threshold of a particle.
[Claim 6] The particle metering device according to claim 1 or 3 characterized by specifying a component from the spectrum of atomic luminescence of a particle, and measuring equivalence particle diameter from the grand total of two or more atomic luminescence reinforcement.
[Claim 7] The particle metering device according to claim 1 or 2 characterized by measuring equivalence particle diameter from plasma luminescence produced in quick time amount, and measuring the component of a particle in the field whose atomic luminescence after attenuation of plasma luminescence can be seen.
[Claim 8] The particle metering device according to claim 1 or 2 characterized by making it lead to a photodetector array after amplifying feeble light, while preparing the multichannel plate which consists of a shutter and an optical amplification means in the front face of a photodetector array and distinguishing plasma luminescence and atomic luminescence.
[Claim 9] Claim 1 characterized by installing wavelength sensing elements, such as a scintillator, in the front face of photograph DAIODO of a wavelength field shorter than 0.2 micrometers which detects atomic luminescence of a photodetector array, or a particle metering device according to claim 2 or 3.
[Claim 10] The particle metering device according to claim 1 characterized by integrating wavelength with the luminescence reinforcement in a quick phase, measuring equivalence particle diameter, and identifying a component with the light of the predetermined wavelength of a subsequent phase.
[Claim 11] The particle metering device according to claim 1 or 3 characterized by using the optical fiber to the wavelength of a vacuum ultraviolet which can transmit light.
[Claim 12] The number of the particles introduced into a cel is a particle metering device claim 1 characterized by controlling by the particle concentration control means, 2, or given in three.
[Claim 13] A photodetector array is a particle metering device claim 1 characterized by being divided into extent which can presume the peak value of each element, 2, or given in three.
[Claim 14] Claim 1 characterized by establishing a cooling means to cool a photodetector array, 2, or a particle metering device given in three.
[Claim 15] Claim 1 characterized by an optical transmission means dividing into plurality the light led to a spectroscope, and making it detect by two or more spectroscopes and photodetector arrays and 2, or a particle metering device given in three.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the particle metering device which achieved the miniaturization of equipment, and low-pricing about the particle metering device which performs elemental analysis of the particle which floats for example, in a clean room, or the particle contained in pure water.
[0002]
[Description of the Prior Art] The particle component analysis equipment using the microwave induced plasma known from the introduction former is briefly explained using drawing 8 . In drawing 8 , 51 is the De Dis parser and the filter 52 to which the solid-state particle (not shown) which should be measured adhered is arranged in this. 53 is an aspirator, attracts the solid-state particle adhering to a filter 52, and supplies it to a coil 54. In addition, helium gas is introduced and the inside of the De Dis parser 51 is maintained by the pressure slightly higher than atmospheric pressure, after air is discharged with a suction pump (not shown). It is the cavity into which, as for 55, the source of microwave is introduced into, and, as for 56, the microwave from the source 55 of microwave is introduced.
[0003] The detection aperture by which 57 was prepared in the other end of a coil 54, and 58 are four optical fibers which lead the light which carries out outgoing radiation from the detection aperture 57 to two or more sets (drawing four sets) (TSUERUNITANA form monochrometer -- monochromator) of spectroscopes 59. The output of this spectroscope 59 is inputted into the signal-processing section (CPU) 60.
[0004] In the above-mentioned configuration, if the microwave whose frequency is 2.45GHz is drawn in a cavity 56 from the source 55 of microwave, the about 4000-degree K plasma will be generated in a coil 54. The solid-state particle drawn in the coil 54 from the De Dis parser 51 on the other hand is atomized and ionized in the plasma, and when it is excited further and falls to a ground state, it emits light. This emission spectrum is picked out from a coil 54 by shaft orientations, a spectrum is carried out with a spectroscope 59, signal processing is carried out by CPU60, and the measurement display of the element in a sample is carried out.
[0005] In addition, each spectroscope 59 is equipped with the optical/electrical converter (not shown) which outputs the electrical signal according to the intensity of light of the selected wavelength. Moreover, in the latter part of an optical/electrical converter, the amplifier (not shown) which amplifies the output signal of an optical/electrical converter is included, and the magnitude of a particle is classified into three kinds of smallness into size, corresponding to the magnitude of the output signal of amplifier.
[0006] Moreover, a filter 52 has a predetermined area, and the aspirator 53 is constituted so that the multiple-times scan of the filter top may be carried out and the particle of the same amount also as each time may be inhaled. Drawing 9 shows the luminescence wavelength of an element, and the relation of luminescence reinforcement, and 50 element extent serves as the measuring object practical. As shown in drawing, Mn has luminescence wavelength near 2600A, and as for aluminum, it turns out that 3950 and F have 6900 near 7800A, and O has luminescence wavelength.
[0007]
[Problem(s) to be Solved by the Invention] By the way, since light is led in equipment to two or more sets (four sets) of the spectroscopes with which measurement wavelength was fixed conventionally [above-mentioned], only four kinds of components can be caught by one luminescence. The class of particle had to measure multiple times, changing the setting wavelength of a spectroscope, since many components may be included as described above, and had the problem that measurement took time amount. Although what is necessary is just to have had many spectroscopes in order to shorten the measuring time, since it was expensive, it not only causes enlargement of equipment, but the spectroscope had the problem of becoming cost quantity. It accomplished, in order that this invention might solve the problem of the above-mentioned conventional technique, and while achieving shortening of the measuring time, it aims at offering the particle component analysis equipment which achieved the miniaturization of equipment, and low-pricing.

[0008]
[Means for Solving the Problem] A means by which this invention introduces a particle in a cel in order to attain this purpose, A means to irradiate a laser beam at the particle in a cel, and a transmission means to transmit atomic luminescence of the particle which emits light by the exposure of a laser beam, the spectrum which carries out the spectrum of the light transmitted by the transmission means -- a means and the photodetector array which receives the light by which the spectrum was carried out -- since -- while making a laser beam into the wavelength besides the luminescence wavelength of a particle, it is characterized by preparing the filter which prevents the wavelength of a laser beam in the preceding paragraph of said optical transmission means.
[0009] Moreover, the laser beam which irradiates a particle considered as pulsed light, and has set up the power density of a laser beam lower than the atomic luminescence threshold of a medium more highly than the atomic luminescence threshold of a particle. Moreover, the reserve electric field of an alternating current are beforehand added to the particle introduced in a cel. A photodetector array is cooled with a cooling means.
[0010] And equivalence particle diameter is measured from plasma luminescence produced in quick time amount among luminescence, and the component of a particle is measured from the spectrum in the field whose atomic luminescence plasma luminescence declines and can be seen.
[0011] The multichannel plate which consists of optical amplification and a shutter is prepared in the front face of a photodetector array, and a shutter is distinguished and turned on and off in a plasma luminescence field and an atomic luminescence field, and after amplifying feeble light, it leads to a photodetector array.
[0012] As a photo detector, the photodetector array which has a detector in an atomic light-emitting part, and other photodetectors are formed, a component is identified, with other photodetectors, atomic luminescence is measured and

equivalence particle diameter is measured [all light including plasma luminescence is measured and] at a photodetector array.
[0013] the spectrum with which this invention carries out the spectrum of the light transmitted by means to introduce a particle in a cel, means to make the particle in a cel emit light using the microwave plasma, transmission means to transmit the light of the particle which emitted light, and the transmission means again -- a means and the photodetector array which receives the light by which the spectrum was carried out -- since -- what becoming -- it is -- [0014] As an optical fiber as a transmission means of light, even a vacuum ultraviolet uses a possible thing and the number of the particles introduced into a cel is controlled by the particle concentration control means. Moreover, when using a photodiode array as a photodetector array, it divides into extent which can presume the peak value of each element, and wavelength sensing elements, such as a scintillator, are installed in the whole photodetector array. Moreover, he divides into plurality the light led to a spectroscope, and is trying to detect by two or more spectroscopes and photodetector arrays.
[0015]
[Function] The particle introduced in the cel can irradiate a laser beam, and emits light by breakdown. this light is transmitted with an optical transmission means -- having -- a spectrum -- a spectrum is carried out by the means. Light is received by the photodetector array and the light by which the spectrum was carried out is changed into an electrical signal. By arranging the photodetector array in the wavelength range of an emission spectrum, the component, the magnitude, and the number of particles can be measured from the relation between wavelength and luminescence reinforcement. By preparing the filter which considers as the wavelength besides luminescence wavelength and prevents the wavelength of a laser beam in the preceding paragraph of an optical transmission means, the wavelength of a laser beam prevents the noise by the laser beam.
[0016] The pulse-ized laser beam can obtain an output without a background by being easy to obtain what has big output density, and making power of a laser beam into a consistency lower than the breakdown threshold of a medium by the consistency higher than the breakdown threshold of a particle. Since the number of the particles introduced into a cel is controlled by the particle concentration control means, the optimal Measuring condition is realizable. Moreover, by adding alternating current electric field to the particle introduced in a cel if needed, even if it makes power of a laser beam small, breakdown can be produced.
[0017] Since he is trying to lead to a photodetector array after measure equivalence particle diameter from the grand total of the plasma luminescence reinforcement produced in early time amount among luminescence, plasma luminescence declines and measuring the component of a particle in the field of atomic luminescence, and preparing further the multichannel plate which consists of optical amplification and a shutter in the front face of a photodetector array, and plasma luminescence and atomic luminescence distinguishing and amplifying feeble light, exact component identification of a particle and measurement of magnitude can do. Moreover, it can integrate with the luminescence reinforcement in a quick phase, equivalence particle diameter can be measured, and the accuracy of measurement can be raised by identifying a component with the light of the predetermined wavelength of a subsequent phase.
[0018] As for a particle, it is possible to also make light emit using the plasma. And although it is common also in breakdown luminescence by the laser beam, transmission of light with short wavelength can be performed, without receiving atmospheric absorption by using the optical fiber which can be used to a vacuum ultraviolet. Moreover, a photodetector array is divided into extent which can presume the peak value of each element, and since it has cooled with the cooling means, exact prolonged measurement is possible for a photodetector array. Moreover, by installing wavelength sensing elements, such as a scintillator, in the front face of a photodetector array, and shifting wavelength to it, by the wavelength sensibility of Si photodetector, light with low sensibility can also be detected and exact component specification can be performed. Hereafter, it explains to a detail based on an example.
[0019]
[Embodiment of the Invention] Drawing 1 is the important section configuration explanatory view showing an example of the gestalt of operation of this invention. In drawing, 1 is the cavity which can be spread without the vacuum-ultraviolet light which intercepted light declining, and the cel 2 which consists of a transparence member is arranged in this cavity. It is a laser generation means, for example, an YAG laser is used as the light source, and 3 uses the thing of the output which are the wavelength of about 1 micrometer, reinforcement 10 - 400mj / pulse, and about 0.1 - 100ns of pulse width. Here, since the luminescence wavelength of the element used as the measuring object is about (refer to drawing 9) 0.15-0.9 micrometers, the wavelength of laser has desirable use of wavelength out of range which does not superimpose the wavelength of a laser beam on the wavelength of a measurement component.
[0020] Laser generated here is made into the diameter of about 0.1mm through a mirror 4 and an aspheric lens 5, and irradiates the particle which moves a part for the converging section of a cel 2. 6 is a particle installation means to send in a particle in a cel, for example, uses the cyclone connected to multistage as shown in drawing 2 .
[0021] In drawing 2 , the air which contains the particle for example, in a clean room slightly is inhaled from inhalation opening of the first step of cyclone 20a. The air inhaled by this cyclone 20a moves caudad like illustration, carrying out the circular motion within a cyclone, and is sucked up by the upper part of a cyclone after that.
[0022] And the particle contained in the air attracted in cyclone 20a falls to the lower part of the cyclone 1 which was pushed against the wall of a cyclone by the centrifugal force and was processed on the mirror plane after that according to it. The particle which fell flows into the 2nd step of cyclone 20b through tube 21a.
[0023] At this time, the inlet 22 of inert gas (for example, helium and Ar gas) is formed in the middle of tube 21a, and a particle is carried to cyclone 20b of the next step with this inert gas. the medium (air) which conveys a particle here -- most (for example, 70%) -- it permutes by helium gas. Furthermore, a particle falls under the cyclone and is conveyed by cyclone 20c of the next step.
[0024] And inlet 21b which introduces helium also in the middle of the tube which connects these cyclones 20a and 20b is prepared, with this helium, air is permuted further and the ratio of air and helium serves as helium99% to air 1. Thus, a medium can be permuted while conveying a particle, using a cyclone as two or more steps. In addition, the concentration of the particle contained in a medium can be adjusted by adjusting the amount of suction of the air of the 1st step.
[0025] Return and 7 are the bundle optical fibers by which the end has been arranged by drawing 1 in a cavity 2, and the other end was connected to it at the spectrum detection means 8. 7a prevents invasion of a laser beam with a filter, and penetrates only the luminescence wavelength of a particle. Here, the optical fiber used by this invention is briefly explained using drawing 3 . Drawing 3 shows the wavelength of light and the relation of an absorption coefficient which are transmitted with an optical fiber, and Curve A shows the absorption property of the silica optical fiber generally

marketed, and has the comparatively good property. However, in the case of the element with which such a good thing also emits light on the wavelength of 1.6 micrometers or less, transmission of light is difficult. Therefore, specification of a component is difficult.

[0026] As an absorption-of-light preventive measure of short wavelength, the purity of glass can be raised and it can solve by terminating the DANGU ring pound between Si and O with a fluorine. In this invention, the optical fiber of the property of extent shown by drawing 3 B which took the above-mentioned measures is used. Transmission of the light to a vacuum ultraviolet is possible for such an optical fiber. In addition, a condenser lens is formed at the tip of the optical fiber located in the vacuum cavity 2 for every one optical fiber, and the edge has become funnel-like, and the light which emitted light is crossed to the large range, and it condenses.

[0027] Drawing 4 is drawing showing an example for impressing alternating current electric field (microwave) to a particle. It is the cel in which the gas by which 2 contains a particle in drawing, such as helium and an argon, flows. 1a is a cavity and 2.45GHz microwave is poured in into this cavity. The hole which serves as a cavernous resonator of microwave and lets cel 1a pass in the center has opened the cavity. And it resonates within a cavity by microwave impregnation, and energy is brought together in a center section. Since breakdown of a particle is promoted by this alternating current electric-field impression, output power of laser can be lessened. The light condensed by drawing 1 with return and an optical fiber is drawn in the spectrum detection means 8 made into the vacua.

[0028] The diffraction grating 9 which receives the outgoing radiation light from an optical fiber 7 in this detection means 8, and is made into the spectral line is arranged, and the spectral line by which the spectrum was carried out by this diffraction grating 9 irradiates the photodetector array (for example, photodiode array) 10. This photodetector array 10 is cooled by the condensator 11 using a Peltier device, liquid nitrogen, etc. It functions as this condensator 11 lessening the dark current of a photodetector, and making a noise level low.

[0029] Drawing 5 (a) and (b) are [the perspective view (b) Figs. of the (a) Fig.] important section decomposition sectional views with a commercial image INTESHI fire (only henceforth I.I). This I.I is constituted from the aperture 31, MCP (multichannel plate)32, a scintillator 33, and an optical fiber 34 by the front face in a shutter 30 and its latter part, and has the magnification function of light. It is possible to amplify feeble light and to detect highly precise luminescence by arranging such I.I in the front face of the photodetector 10 shown in drawing 1 if needed.

[0030] The shutter of this I.I is turned on and off synchronizing with the pulse of laser, and functions as a means to distinguish and measure identification and reinforcement of the reinforcement of a plasma luminescence field, or the wavelength (lambda) of an atomic luminescence field.

[0031] In the above-mentioned configuration, above the breakdown threshold to which a particle emits light, a laser beam is impressed to the power below the breakdown threshold of a medium (an example helium), and is irradiated at a part for the converging section of a cel (if a particle is placed into the light of high density, from a picosecond, by the nanosecond, it will be heated and it will carry out white luminescence.). After that, it decomposes even into each atomic unit, and a particle is set to an excitation state, and carries out firefly luminescence among about 10 nanoseconds. This light is called laser breakdown. It seems that the situation of luminescence is shown in drawing 6 in luminescence by breakdown.

[0032] The part which shows the part shown by A in drawing 6 by the white light by plasma luminescence and B is luminescence by the class of element. The luminescence reinforcement of wavelength peculiar to a luminescence element is shown by the inside Td of drawing, it appears after [of plasma luminescence] 0.1 - 0.5 microseconds, and decreases a time delay and Tg with the passage of time. It is condensed with the optical fiber shown in drawing 1 , and the spectrum of such a light is carried out by the diffraction grating 9, and it irradiates the photodetector array 10. In addition, although omitted by a diagram, a signal processor is connected to the latter part of a photodetector array, and the electrical signal for every component which constitutes an array is processed. and the magnitude of the signal resulting from the strength of the white light to a component -- calculating -- predetermined time -- (-- it Td(s)) is behind and a component is specified from the electrical signal of the wavelength (lambda) to generate.

[0033] As shown in drawing 7 , at least three photodetectors are arranged to the wavelength on which one element emits light, and the photodetector array used by this invention specifies the component of an element in quest of the peak of luminescence from the output of this three photodetector. In drawing 7 , it is a photodiode array, for example, and when [for which what is shown by I, RO and Ha constitutes a photodetector array] the output levels of such diodes are A, B, and C, the luminescence peak of this element specifies that it is B, and identifies the component of an element from wavelength here. In addition, luminescence wavelength can be shifted to a side with sensibility good as a whole by what wavelength sensing elements, such as a scintillator, are prepared for on the surface of a photodetector (a fluorescent substance is applied), and, also in the wavelength shorter than 0.2 micrometers from which only low sensibility is obtained, detection becomes easy in the photodetector using Si.

[0034] In measuring an equivalent grain size, since luminescence reinforcement differs even if each element has the same magnitude, each element (for example, 50 kinds) of a known particle size shall be made to emit light by laser breakdown beforehand, and it shall ask for the magnitude of an element, and the relation of an output signal. Furthermore, two or more particles are measured in measurement of an equivalent grain size, and an equivalent grain size is presumed based on the average. In addition, in the gestalt of this operation, although the medium which carries a particle was explained as a helium, a medium may be not only a gas but a liquid (for example, water).

[0035] Moreover, light may be made to emit as a means to make a particle emit light, using the microwave plasma. In this case, the vacuum cavity 1 shown in drawing 1 becomes the source 55 of microwave shown in drawing 7 , a coil 54, and KYABII 56. In addition, as shown in drawing 9 , a **** part has the relation between an atom and luminescence wavelength like the range shown by a part and B with atomic dense luminescence wavelength like the field shown by A. In such a case, it is disadvantageous on cost to divide the whole photodetector array finely according to a dense part.

[0036] So, in this invention, the diffraction grating 9 in the spectrum detection means 8 and two or more sets photodetector array 10 grade are prepared, and an optical fiber divides into plurality the light led to these. And it constitutes so that the range shown by the above-mentioned A and the range shown by B may be classified and measured. If it is made this appearance, the consistency of the photodetector array which measures the field of B at least can be manufactured to a non-dense.

[0037]

[Effect of the Invention] A means to introduce a particle in a cel according to this invention as explained to the detail above, A means to irradiate pulse laser light at the particle in a cel, a transmission means to transmit atomic luminescence of the particle which emits light by the exposure of a laser beam, the spectrum which carries out the spectrum of the light transmitted by the transmission means -- while having the photodetector array which receives a

means and the light by which the spectrum was carried out and making a laser beam into the wavelength besides the luminescence wavelength of a particle, the filter which prevents invasion of the wavelength of a laser beam in the preceding paragraph of said optical transmission means is prepared. Consequently, the magnitude of an element particle can be known from the strength of plasma luminescence, without being influenced of the laser beam used as a noise, and an element component can be identified from the spectrum of atomic luminescence.

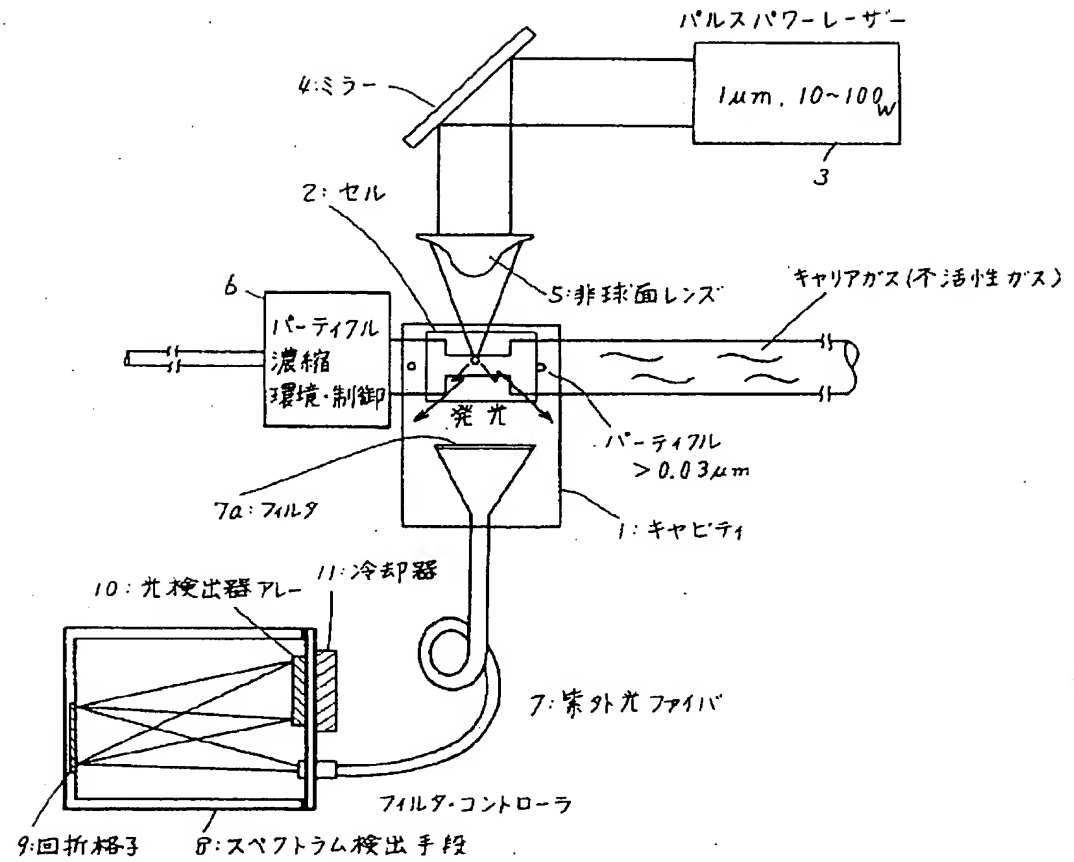
[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the important section configuration explanatory view showing an example of the gestalt of operation of this invention.
[Drawing 2] It is the sectional view showing the concentration control means and medium permutation device of a particle.
[Drawing 3] It is drawing showing the luminescence wavelength of an optical fiber and the relation of luminescence reinforcement which are used by this invention.
[Drawing 4] It is the explanatory view showing a means to impress electric field to a particle.
[Drawing 5] It is the schematic diagram showing an optical amplification means.
[Drawing 6] It is drawing showing the situation of luminescence by breakdown.
[Drawing 7] It is drawing showing an example of the photodetector array used by this invention.
[Drawing 8] It is the configuration explanatory view of the conventional example.
[Drawing 9] It is drawing showing the relation of the luminescence reinforcement and wavelength of each element.
[Description of Notations]
1 Cavity
2 Cel
3 Laser Outgoing Radiation Equipment
4 Mirror
5 Aspheric Lens
6 Particle Concentration Means
7a Filter
7 Ultraviolet Radiation Fiber
8 Spectrum Detection Equipment
9 Diffraction Grating
10 Photodetector Array
11 Condensator

[Translation done.]

Drawing 1



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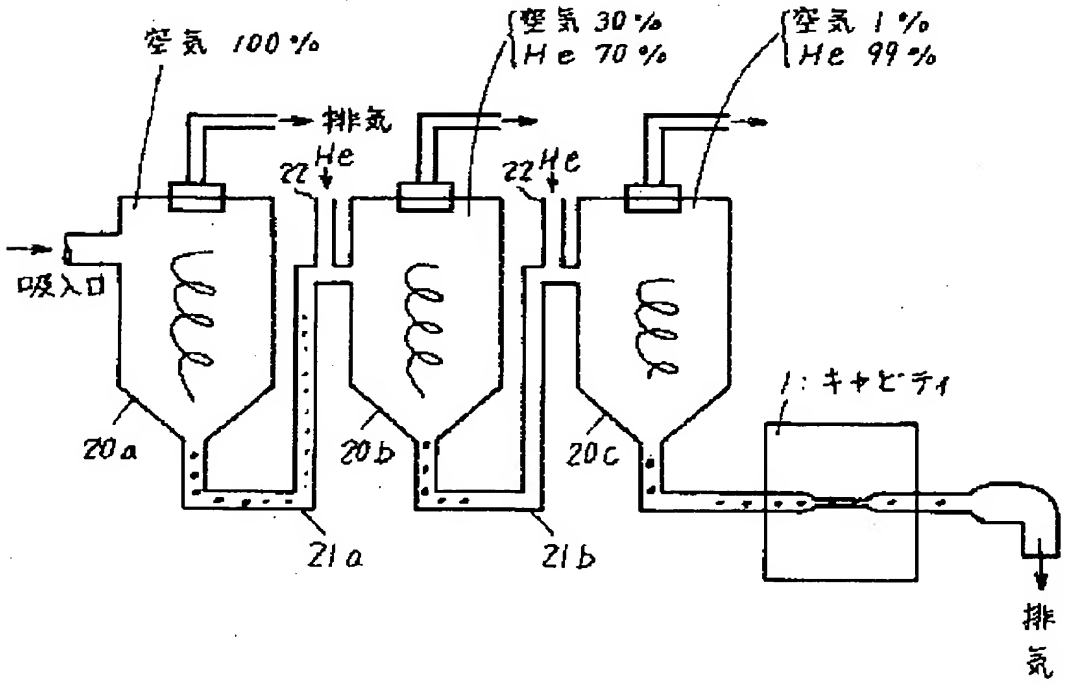

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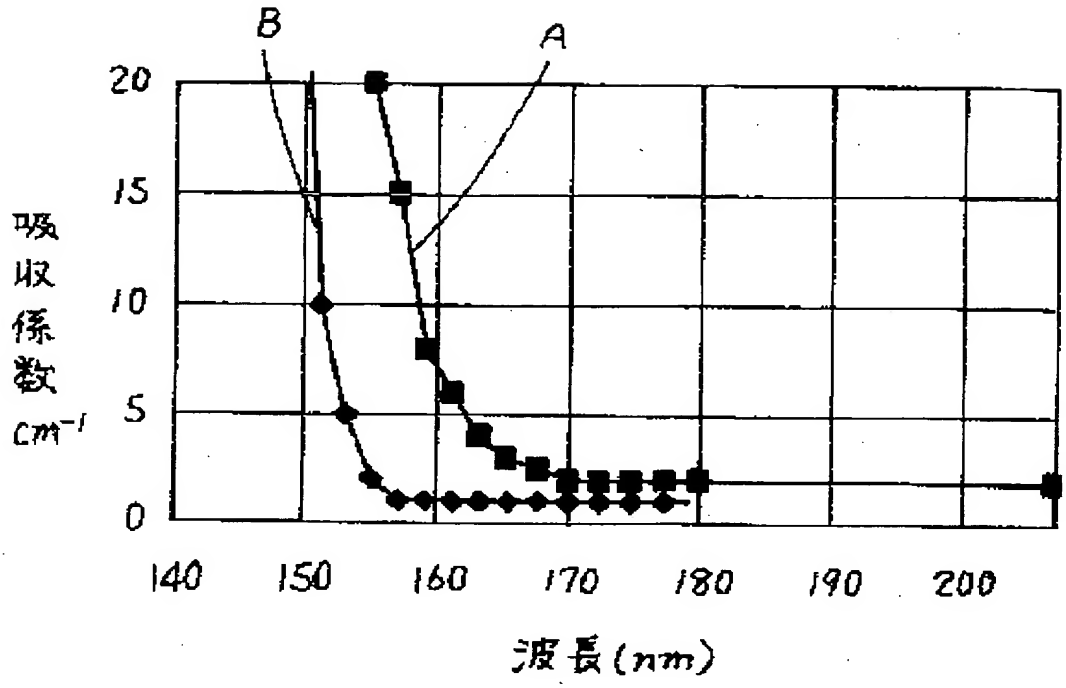

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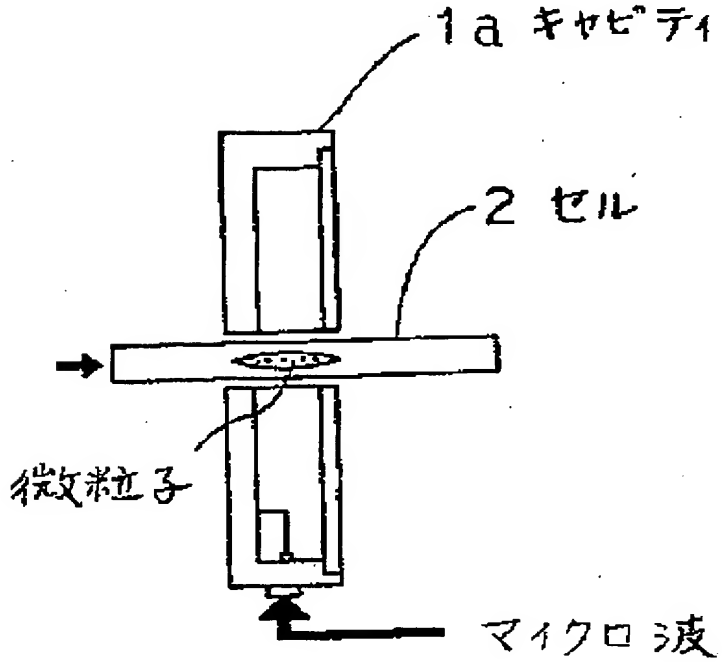

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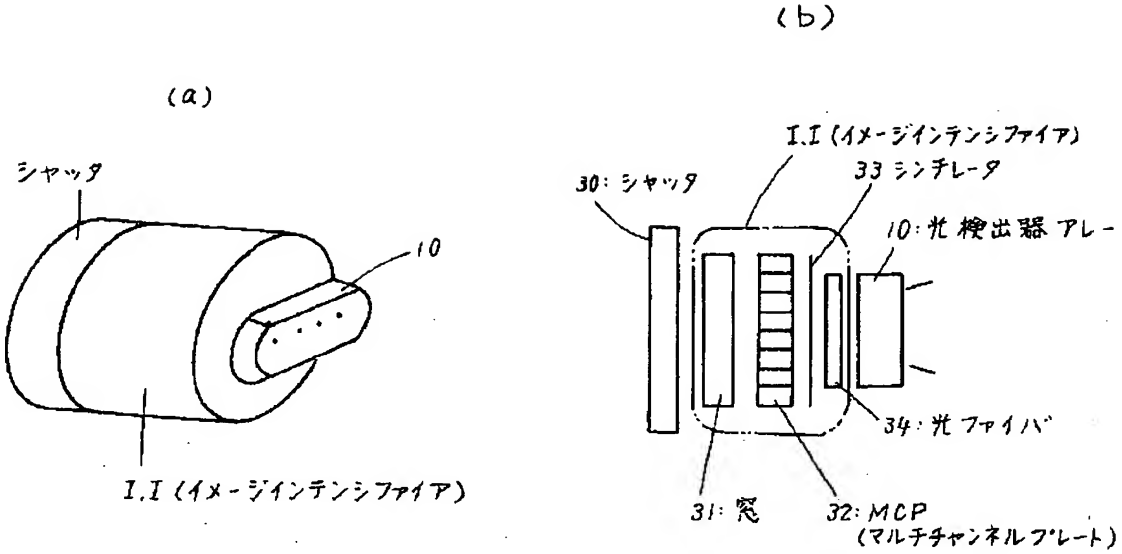

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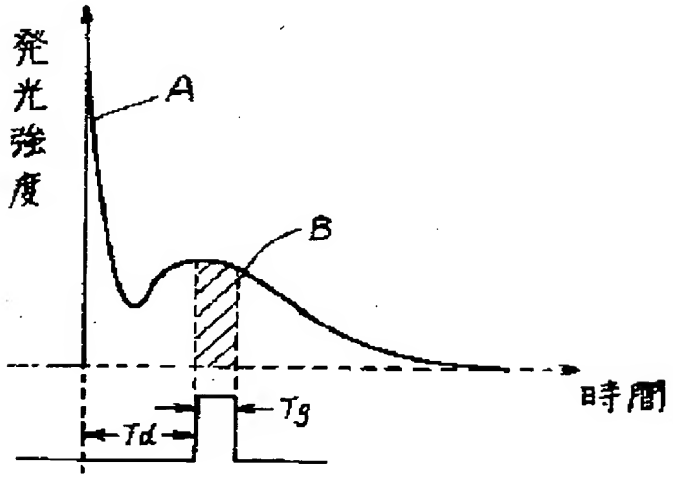
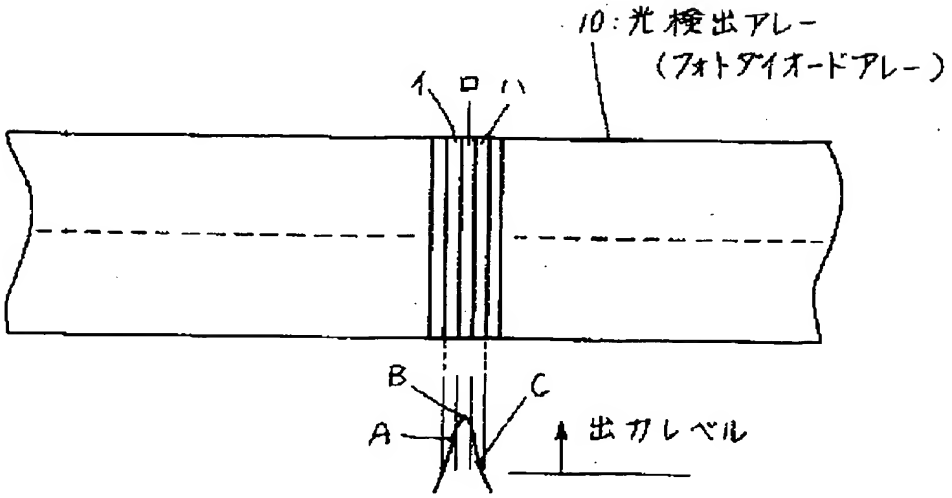
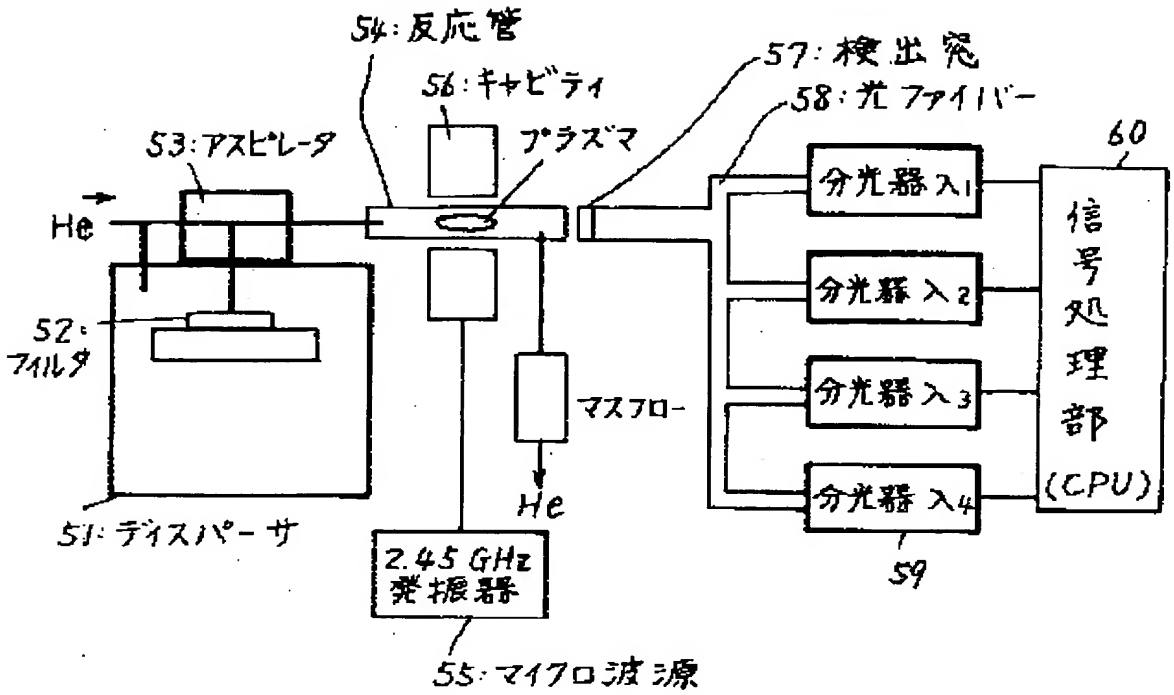


Drawing 7



Drawing 8


54:反応管
56:キャビティ
57:検出窓
58:光ファイバー
60
53:アスピレータ
プラズマ
He
分光器入1
分光器入2
分光器入3
分光器入4
信号処理部
(CPU)
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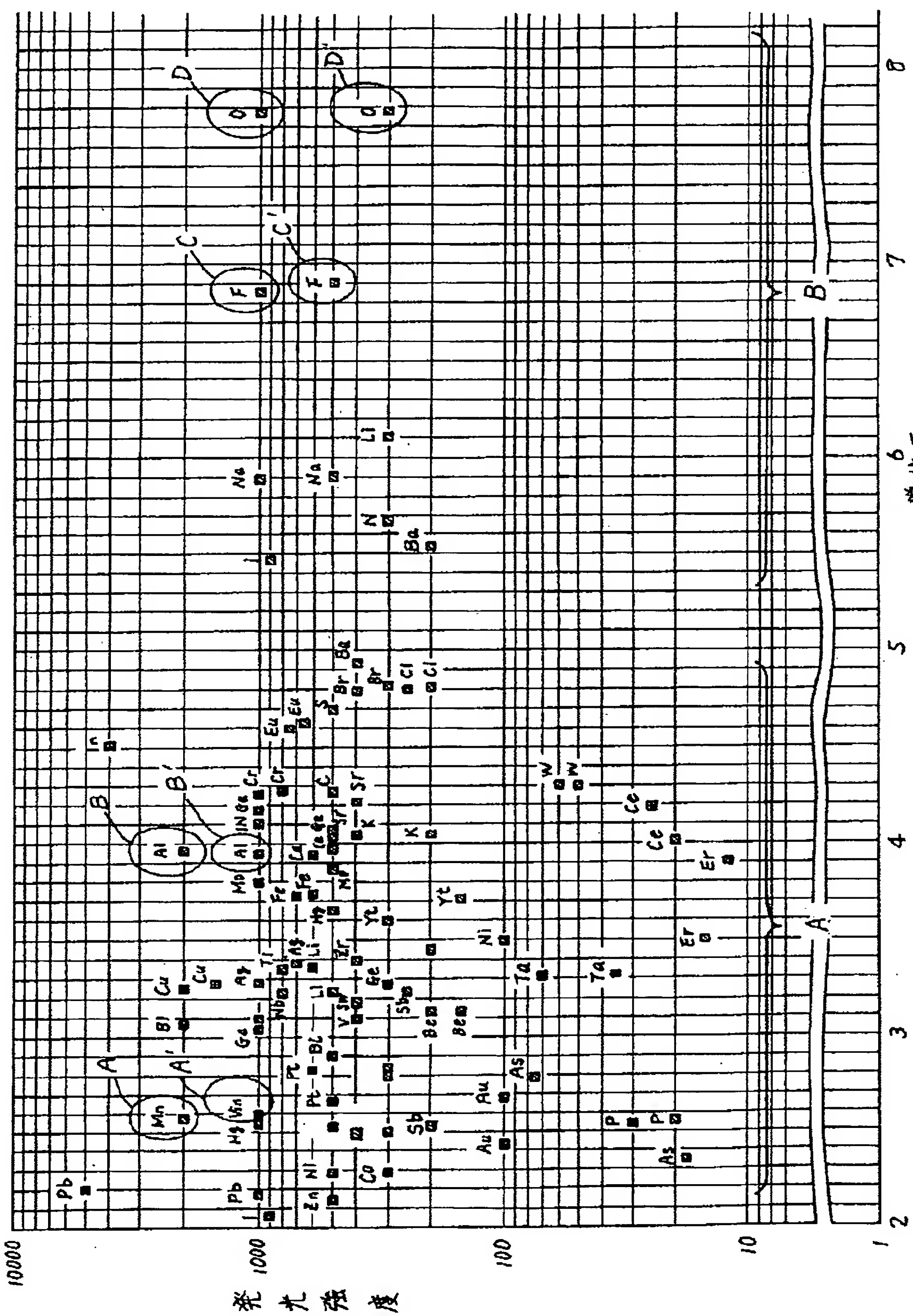
Drawing 9



CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 1st partition of the 6th section
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[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] 0032
[Method of Amendment] Modification
[Proposed Amendment]
[0032] The part which shows the part shown by A in drawing 6 by the white light by plasma luminescence and B is luminescence by the class of element. The inside Td of drawing is the time amount in which the luminescence reinforcement of wavelength peculiar to a luminescence element appears, a time delay and Tg appear, while being 0.1 - 0.5 microseconds, and it decreases them with the passage of time. It is condensed with the optical fiber shown in drawing

1, and the spectrum of such a light is carried out by the diffraction grating 9, and it irradiates the photodetector array 10.

In addition, although omitted by a diagram, a signal processor is connected to the latter part of a photodetector array, and

the electrical signal for every component which constitutes an array is processed. and the magnitude of the signal resulting from the strength of the white light to a component -- calculating -- predetermined time -- (-- it Td(s)) is behind and a component is specified from the electrical signal of the wavelength (lambda) to generate.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0036
[Method of Amendment] Modification
[Proposed Amendment]
[0036] So, in this invention, the diffraction grating 9 in the spectrum detection means 8 and two or more sets photodetector array 10 grade are prepared, and an optical fiber divides into plurality the light led to these. And it constitutes so that the range shown by the above-mentioned A and the range shown by B may be classified and measured. If it is made this appearance, the consistency of the photodetector array which measures the field of B at least can be manufactured to a non-dense.

[Translation done.]